



May 26, 2004

MEMORANDUM FOR All Staff, Building 235

From: Patrick Gallagher
Director, NCNR

Subject: Safe handling and use of cadmium and lead shielding materials

PURPOSE:

The purpose of this memo is to heighten the awareness of the toxic hazards in handling cadmium and lead materials used at the NCNR.

GENERAL USE OF LEAD AND CADMIUM METAL

Lead bricks and cadmium sheet are common shield components. Both materials produce a loose oxide scale, that can be easily transferred to hands or clothing. Lead is soft enough to be smeared onto adjacent materials. Cadmium is a heavy metal and must be treated as a hazardous material, especially in the forms of vapor or dust.

USE OF CADMIUM IN SAMPLE ENVIRONMENTS

Although the melting point for cadmium is 594 K (321 C), its vapor pressure becomes unacceptably high at the much lower temperature of 421 K (148 C) (equivalent to a deposition rate of 10 layers/sec). Except in air, cadmium should not be used as a shielding material above room temperature. (*In air, Cd forms a capping oxide layer to limit evaporation and can be used up to 473 K (200 C).) Warning labels to this effect have been added to the high temperature closed-cycle refrigerators (CCRs) and furnaces.

Alternatives are available for neutron shielding around a sample at high temperatures. Both gadolinium oxide paint (Gd_2O_3) and boron nitride paste (BN) can be used to the temperatures accessible in the high temperature CCRs (600-800 K). Both of these materials can be found in the high bay sample preparation area.

PERSONAL PROTECTION

Ingestion and inhalation are the major routes of entry. Gloves, coveralls and lab coats should be used to minimize contamination. Hands should be thoroughly washed before eating. Inhalation is usually the most dangerous (and overlooked) route of entry. When handling the material, fine dust can be dispersed into the air. This is a particular problem when handling older lead bricks. Disposable dust masks are not an effective protective device. Fitting and testing of respirators needs coordination with the safety office and the health unit as described in HSI #17 found at <http://www-i.nist.gov/admin/ohsd/hsinstre.htm>

HOUSEKEEPING

Keep all cadmium and lead waste separate for hazardous disposal. Cadmium or lead is NOT to be put into general waste containers. Separate, labeled, plastic containers for lead and cadmium waste are located throughout the facility. If you need a labeled container, contact John Barker (x6732).

Before removing material from a controlled area such as C100 (confinement room) or G100 (Guide Hall), the material must first be checked by Health Physics.

HEALTH HAZARD SUMMARY (see MSDS sheets for more information)

LEAD: Short term (acute) overexposure affects the brain and can produce seizures, coma, and death. Long term (chronic) overexposure attacks the blood-forming, nervous, urinary (kidney disease) and reproductive systems.

CADMIUM: Short term (acute) overexposure can produce pulmonary edema within 24 hours. Long term (chronic) overexposure results in kidney damage, and increases the risk of lung and prostate cancer.

REGULATORY INFORMATION

Work place exposure to lead is covered in the Code of Federal Regulations 29.1910.1025, while cadmium is covered in 29.1910.1027. Various action levels of exposure and minimum action programs are described. Since our normal work exposure is far below the action levels, routine medical surveillance and air sampling programs are not instituted.

Any work beyond routine handling of these materials must be discussed with the NCNR Safety Representative (John Barker) to evaluate whether there is the possibility of producing exposures at actionable levels. Work that has the potential to produce actionable exposure levels must have written procedures reviewed by the NCNR Hazard Review Committee and approved by the NCNR Director prior to starting the work.

For airborne contamination, the action levels are 0.0025 mg/m³ for cadmium, 0.03 mg/m³ for lead.